UNIVERSITY OF NIŠ
Faculty of Technology, Leskovac

BOOK OF ABSTRACTS

15th INTERNATIONAL SYMPOSIUM „NOVEL TECHNOLOGIES AND SUSTAINABLE DEVELOPMENT“

Leskovac, October, 20-21, 2023.

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OPTIMIZATION OF THE HETEROGENEOUSLY CATALYSED METHANOLYSIS OF PLUM KERNEL OIL IN THE PRESENCE OF MENTHOL-BASED DEEP EUTECTIC SOLVENT

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Waste plum kernels from the fruit processing industry might be a valuable oil source for biodiesel production which use can reduce the biodiesel production cost. The application of green cosolvents, like deep eutectic solvents (DESs), in the alcoholysis reaction can improve the oil conversion rate. This study reports on the optimization the plum kernel oil methanolysis over 35CaO/ZP (35% CaO supported on a fly ash-based zeolite) in the presence of triethanolamine:menthol (TEOA:M, 2:1 mol/mol) DES as cosolvent. The reactions were carried out in a 250 mL batch magnetic stirred reactor (900 rpm) with a reflux condenser under atmosferic pressure and at 60 °C. The effect of the catalyst amount (2-10% based on the oil mass), TEOA:M DES amount (1-9% based on the oil mass) and methanol:oil molar ratio (6:1-12:1 mol/mol) on the fatty acid methyl esters (FAMEs) content was analyzed according to a Box-Behnken design. The obtained experimental data of the FAME content were modeled by a second-order polynomial equation and the response surface methodology was used for determining the optimal reaction conditions for achieving the highest FAME content. According to the analysis of variance (ANOVA), the catalyst amount had the most significant influence on the FAME content, followed by the TEOA:M DES amount and the methanol:oil molar ratio. By analyzing the second-order polynomial equation, it can be concluded that the catalyst amount and TEOA:M DES amount have a positive effect on the FAME content. The maximum FAME content (99.67%) was achieved under the following optimal reaction conditions: catalyst amount of 8% (based on the oil mass), TEOA:M DES amount of 4.8% (based on the oil mass), and methanol:oil molar ratio of 6.1:1.

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KINETIC MODELING OF THE BIODIESEL PRODUCTION FROM SUNFLOWER OIL OVER CORN COB ASH

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In recent years, researchers have focused on obtaining sustainable and low-cost catalysts from agricultural and industrial waste to be applied in biodiesel production. Such biomass waste is corn cobs that can be utilized for heat generation by combustion, and the remaining ash can be tested for catalytic activity in biodiesel production. Therefore, this study deals with the refined sunflower oil methanolysis over corn cob ash obtained by the combustion of corn cobs in a solid fuel stove. The aim is to analyze the reaction kinetics. The reactions were carried out in a batch reactor with a magnetic stirrer under atmospheric pressure and at the following reaction conditions: temperature of 60 °C, a methanol-to-oil molar ratio of 9:1, and a catalyst amount from 4 to 10% of the oil weight. The variations of fatty acid methyl esters (FAMEs) content with the reaction time showed no mass transfer limitations in the initial reaction period. Therefore, the simple pseudo-first-order model was employed to describe the kinetics of the oil methanolysis. The determined reaction rate constants increased with the increase in catalyst amount from 4 to 10%, and the corresponding values were 0.095 min^{-1}, 0.291 min^{-1}, and 0.307 min^{-1}. A low mean relative percentage deviation of ±5,63% (based on 21 data) between the calculated and experimental values of the conversion degree of triacylglycerols confirmed that the kinetic model of the irreversible pseudo-first-order reaction fitted the experimental data satisfactorily.